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TP 1624

Marine Casualty Investigations

Enquêtes sur les accidents maritimes

Investigation Report to the Minister pursuant to sections 542 or 545 of the Canada Shipping Act

Rapport d'investigation au Ministre conformément aux articles 542 ou 545 de la Loi sur la marine marchande du Canada

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INVESTIGATION REPORT INTO THE CIRCUMSTANCES SURROUNDING THE VIOLENT STRIKING OF THE DOCK BY THE CANADIAN BULK CARRIER "RICHELIEU", WITH HEAVY DAMAGE, WHILE BERTHING AT SECTION 105 IN QUEBEC, QUEBEC ON MARCH 25, 1986.

REPORT No. 444

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OCT 25 1988
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INVESTIGATION REPORT INTO THE CIRCUMSTANCES SURROUNDING THE VIOLENT STRIKING OF THE DOCK BY THE CANADIAN BULK CARRIER "RICHELIEU", WITH HEAVY DAMAGE, WHILE BERTHING AT SECTION 105 IN QUEBEC, QUEBEC ON MARCH 25, 1986.

Particulars of Vessel

Name	"RICHELIEU"
Official Number	323022
Port of Registry	Toronto
Call Sign	VGJC
Length	222.44 m
Breadth	22.97 m
Depth	12.10 m
Draught at time of casualty	8.40 m forward 8.53 m aft
Gross Tonnage	17,822
Net Tonnage	13,472
Built	1967, Chantier naval Davie, Lauzon, Quebec
Type	Bulk carrier
Engine	One, six cylinder Sulzer diesel, (9600 b.h.p.)
Crew	24
Classification Society	Lloyd's Register of Shipping
Owners	Canada Steamship Lines Inc. Montreal, Quebec

Note: All times given in this report are expressed in Eastern Standard Time. (*UTC minus 5 hours).

* UTC - Co-ordinated Universal Time

Background

On March 24, 1986 the bulk carrier "RICHELIEU" departed Port Cartier, Quebec with a cargo of iron pellets, bound for Contrecoeur, Quebec.

On the run between Les Escoumins and Quebec a failure occurred in the main engine's remote control system making it necessary to operate the engine manually from the engine-room and it was therefore decided to lay-over in Quebec to carry out repairs.

During berthing manoeuvres in Quebec the vessel violently struck the dock twice, severely damaging her bow. Nevertheless, she continued her voyage at reduced speed to Contrecoeur the following morning and discharged her cargo prior to proceeding to Montreal to effect permanent repairs.

Narrative

The "RICHELIEU" departed Montreal, at 0640 on March 22, 1986 on her first voyage of the season, bound for Port Cartier. She arrived there at approximately 2200 on March 23 and loaded 27,864 tonnes of iron pellets.

At 1405 on March 24 the "RICHELIEU" departed Port Cartier for Contrecoeur. The vessel arrived off Les Escoumins at 0110 on March 25 where she was boarded by two pilots for the purpose of conducting her to Quebec.

At 0732 on March 25, while the vessel was in the vicinity of Grande Batture, the main engine, which was on bridge control, suddenly stopped. As the pressure guage indicated that there was hardly any air pressure in the engine remote control system the *E.O.W. went to the manual control stand and manually restarted the engine but the vessel barely moved ahead. In attempting to use more power the E.O.W. pushed the throttle and caused the engine to overspeed. This brought the overspeed mechanism into service and stopped the main engine. The E.O.W. then called the chief engineer. On his arrival the chief engineer restarted the engine and adjusted the propeller pitch to match the engine r.p.m. The voyage then continued to Quebec without incident.

* E.O.W. - Engineer on watch

In view of the anticipated engine manoeuvres which would be required to proceed upstream in the partially ice covered waters, it was decided to stop in Quebec and try to find the cause of the problem and to carry out the necessary repairs if possible.

The vessel arrived in the port of Quebec at 1430 on March 25, at which time the crew went to their mooring stations. The vessel's draught was 8.40 m forward and 8.53 m aft. It was snowing lightly but the visibility was good. The tide had been on the rise for an hour and there was a light north-easterly wind. The sea was calm and covered 1/10 to 2/10 with ice.

On the bridge were the two pilots, the master and the helmsman. The chief engineer was in the engine-room at the manual control stand ready to execute the orders from the bridge as transmitted on the telegraph and at his side was the E.O.W.

The first pilot carried out the initial approach to the dock in the following manner:

Since it was intended to berth the vessel port side to, at section 105 in Anse au Foulon (see chart), she was steered on a course of 205°T, at slow speed while approaching as closely as possible to the South shore. When abeam of the Ultramar wharf the engine was put to 'full ahead' so as to make a semi-circular turn to starboard. As soon as the turn was completed and the vessel was headed in the direction of her berth, speed was reduced to 'slow ahead' for a short time, then followed by 'stop'.

Up to this point it seems that everything ran smoothly. To prevent the engine from cooling excessively, the E.O.W. on orders from the chief engineer stopped the raw water circulating pump of the main engine.

When the vessel was approximately 3 ship lengths away from her berth the pilot ordered 'half astern' and then 'full astern'.

While the chief engineer was restarting the engine the E.O.W. went to restart the circulating pump. On his return to the control station the E.O.W. noticed that the propeller pitch was in the 'ahead' direction. Believing that the chief engineer had made a mistake and that the engine was propelling the vessel ahead he stopped the engine by placing the telegraph handle to 'stop'.

Since the vessel was approaching the dock rather quickly

and it seemed that a collision was imminent, the pilot ordered the starboard anchor to be let go with two shackles of chain, and remarked to the master that they would strike the dock.

The master reacted by ordering the helmsman to put the helm to 'hard-a-port' and put the bow thruster into operation to help with the turn to port. The vessel struck the dock with her starboard side in the area of her anchor recess. The impact cut the starboard anchor chain and turned the vessel in a direction almost parallel to the dock. The vessel stopped for a moment and then, under the probable influence of the flood tide, commenced to move forward. The master again asked the engine-room for 'half astern', then 'full astern', and then he ordered to let go the port anchor.

When the chief engineer restarted the main engine, the r.p.m. were slow to rise probably because of excessive pitch on the propeller, which would have overloaded the engine. In an attempt to help the engine accelerate the chief engineer reduced the pitch of the propeller and in doing so accidently reversed the pitch. The E.O.W. who was watching the pitch indicator noted with satisfaction that this time, the propeller pitch was in the astern mode. The result of this manoeuvre was to give the vessel a movement ahead instead of a movement astern as requested by the master.

On noticing that the pitch indicator showed 'astern' pitch when it should have been showing 'ahead' pitch, the master ordered 'stop engine'. However, it was too late, the vessel struck section 107 at 1500.

The "RICHELIEU" was finally secured, starboard side to, at section 106 using her winches rather than her engine. The bow of the vessel was damaged extensively, it was pushed back approximately 40 cm, from the 4.0 m draught mark up to the forecastle deck, and because of a hole in the bow the forepeak was flooded to the water level. The deck was also extensively damaged. However, no pollution was caused by the casualty.

Shortly after the casualty occurred, the master reported it to the owners and to the Coast Guard. The loss of the starboard anchor with its one shackle of chain, approximately 25 m offshore between sections 104 and 105, was also reported.

While in Quebec, the ship's engineers temporarily restored to working order the engine remote control system from the bridge and in the engine-room. The "RICHELIEU" was then inspected by a Canadian Coast Guard Ship Safety surveyor

who authorized the vessel to continue her voyage to Contrecoeur to discharge her cargo and then to proceed to Montreal for permanent repairs.

Analysis

1. Qualification and experience of personnel

The master holds a Master Inland Waters, Certificate of Competency, issued in 1974. He has served approximately 30 years in Great Lakes vessels, 12 years of which he served as master. He has been in command of the "RICHELIEU" for 3 years.

The chief engineer holds a First Class Engineer, Steam and Motor Combined, Certificate of Competency issued in 1966. He has served in this Company's vessels for 36 years, 22 of which were in the capacity of chief engineer. He has served 2 years on board the "RICHELIEU".

The second engineer holds a Third Class Engineer, Motor, Certificate of Competency, issued in 1971. He has served on board Great Lakes vessels for nearly 30 years, 16 which were in the capacity of engineering officer. He has served on the "RICHELIEU" for the last 10 years, and was responsible for the 4-8 watch.

The third engineer also holds a Third Class Engineer, Motor, Certificate of Competency, issued in 1964. He has served on board the "RICHELIEU" for 7 years and was responsible for the 12 to 4 watch.

The first pilot holds a Class A pilot's licence issued in 1966 and has piloted vessels between Les Escoumins and Quebec since 1958. On March 25, 1986 he conducted the "RICHELIEU" to Quebec and manoeuvred the vessel for berthing port side to, at pier 105. He was aware of the failure of the bridge controls to the main engine and manoeuvred the vessel prudently and in accordance with the ordinary practice of seamen.

2. Main engine and remote control system

The main engine of the "RICHELIEU" is a Sulzer diesel, type GRD-76, developing 9600 b.h.p. and driving a variable pitch propeller. The remote control system is pneumatic. The main engine can be controlled from three separate locations, i.e. the bridge, the engine control panel in the engine-room and the manual control stand at

the engine itself.

Under normal conditions the main engine is controlled from the bridge, and when this is the case, the engine always turns in the same direction, i.e. 'anti-clockwise'. The vessel is propelled ahead or astern by adjusting the propeller pitch. The propeller pitch operates in conjunction with the speed lever. When the lever is at neutral the propeller pitch is at zero. When the speed lever is pushed to either ahead or astern the propeller pitch is adjusted accordingly. The engine revolutions increase proportionately to the pitch adjustment. The response of the engine to the controls is rapid and efficient.

In case of problems with the engine controls on the bridge the master can resort to the bridge telegraph. The main engine is then controlled from the engine control console in the engine-room and operates in a similar manner to that described in the previous paragraph, with one exception, it is now the E.O.W. who controls the engine in accordance with orders transmitted on the telegraph.

3. **Alternative means of engine control**

There is also another means of controlling the engine from the control panel in the engine-room. The engine orders are transmitted from the bridge on the telegraph or by other means of communication. At this point, the E.O.W. can reverse the direction of rotation of the engine, manually adjust the pitch of the propeller, start or stop the engine and regulate the speed as required.

In case of emergency, a fourth option is available. Depending on the circumstances, e.g. if all the compressed air has been used up or if, for some reason, it is not possible to control the engine from the three positions mentioned earlier one can do it from the manual control stand situated at the base of the forward end of the engine.

When the engine is controlled manually the propeller pitch must also be adjusted manually and in proportion to the engine's speed.

At the manual control stand there is a propeller pitch indicator showing 'ahead' pitch in black and 'astern' pitch in red. This indication of pitch direction holds true only when the engine is being controlled under

normal circumstances where the engine always turns in the same direction and where the pitch of the propeller is adjusted to make the vessel move ahead or astern.

When the engine is controlled manually, astern movement is accomplished by reversing the rotation of the engine. It is most important that the propeller pitch remains in the ahead mode, otherwise a contr ry thrust will result.

The engine-room personnel were not accustomed to controlling the engine manually and the chief engineer who had never controlled the engine from the manual control stand in the ship was not familiar with the controls.

There was a device located near the engine-room telegraph at the manual control stand which permitted the total shut-off of compressed air to the other engine control stations and which would become activated whenever the engine telegraph handle was moved from the 'Remote Control' position.

From the manual control stand the propeller pitch can be adjusted from 0 to 10 (max.) in the ahead mode only. The astern mode is accomplished by reversing the rotation of the engine.

When the engine is controlled from the manual control stand, the time taken to go from ahead to astern, or vice-versa, is considerably longer because the engine must be stopped, then the various cam shafts must be moved to cause rotation in the desired direction. The engine has to be restarted, the speed increased as required and at the same time the propeller pitch must be adjusted proportionately to the speed of the engine r.p.m.

4. **Air shut-off device**

Prior to the casualty, at 0732, when the engine stopped by itself, the E.O.W. noticed that the pressure guage indicated that there was no air pressure in the engine remote control system. Not wanting to lose any time, he restarted the engine directly from the manual control stand.

It was later discovered that the loss of air pressure was caused by a defect in the air shut-off device near the engine telegraph at the manual control stand. The result of the defect was to cut off the air to all the other control stations, just as if the telegraph handle

had been moved from the 'Remote Control' position. This device is identified as part No. 333-39PA in the pneumatic remote control system, manufactured by Sulzer.

As long as the problem was not located and the part not replaced the engineers had no other choice but to control the engine manually.

5. **Main engine manual control system**

The manual control system of this engine was designed to make it impossible for the engine to rotate in the wrong direction.

If, for example, the ship was stopped and the master ordered an ahead movement on the telegraph, the mechanism which controls the direction of rotation in the engine and is directly linked to the telegraph, automatically places itself in the ahead position. During the time that the mechanism puts itself into position the engine starting lever is blocked and cannot move. It is only when the cam shaft is in the ahead position, as set on the telegraph, that the engine can be started.

If the bridge now orders an astern movement the telegraph must pass through the stop position. The result of this is to cut off fuel to the engine even if the speed regulating lever is in the operating position. When the telegraph is then moved to an astern setting, the mechanism places itself in position to effect an astern movement and once again, during the time that it takes for this operation, it is impossible to restart the engine.

If ever the engine is started in the wrong direction the fuel feed to the engine is automatically cut off.

When the engineer starts the engine, he must adjust the propeller pitch in relation to the speed. Normally the propeller pitch cannot be reversed because of a blocking cam located on the shaft of the adjusting knob, thus permitting forward pitch adjustment only.

When the rotation of the engine is reversed to obtain an astern movement as in the case when controlling the engine from the manual control stand it is very important that the propeller pitch be left in the ahead position otherwise a movement contrary to the one desired by the bridge personnel will be obtained. This is the reason for the blocking cam on the shaft of the propeller pitch adjusting knob of this control station.

If, under these conditions, the propeller pitch is nevertheless reversed, no alarm will sound, because the engine is in fact rotating in the direction indicated on the telegraph.

6. **Blocking cam**

After the casualty, it was discovered that the blocking cam (constructed of plastic material) was cracked. This resulted in rendering useless the locking screw which held the blocking cam securely to the shaft of the adjusting knob. This plastic part could therefore turn round the shaft making it possible to reverse the propeller pitch.

At the time of the casualty the third engineer was on watch. However, since the engine-room personnel were not used to controlling the engine manually, the chief engineer took charge of manoeuvring the engine from the manual control station. A little before the first striking, when the bridge had ordered 'full astern' on the telegraph and while the chief engineer was restarting the engine, the E.O.W. went to restart the raw water circulating pump for the main engine. On his return he noticed that the telegraph was set to 'full astern' whereas the propeller pitch was set to 'full ahead'. Believing that the chief engineer had made a mistake and that the engine was propelling the ship in the wrong direction, he stopped the engine.

The stopping of the engine while 'full astern' was still being required by the bridge personnel may explain why the vessel approached the dock at a greater speed than intended with the resultant striking.

After the first striking, and as the vessel commenced to move again, probably due to the influence of the flood tide, the master again ordered 'half astern' and then 'full astern'. The chief engineer restarted the engine in the astern mode and set the propeller pitch to astern and the E.O.W. who was watching the pitch indicator noted with satisfaction that, this time, the propeller had the right pitch. This, however, resulted in the vessel being subjected to a forward movement instead of an astern one as required by the master. This is why the vessel accelerated more and more along sections 105 and 106 and ran directly into section 107. This time the impact was considerably more violent that the first one and caused extensive damage to the bow of the ship and to the dock.

7. Tides

Low tide at Quebec, on March 25, 1986 was at 1325 and high tide at 1815. At the time of the casualty, between 1430 and 1500 the tide was flooding and the current was flowing at a rate of approximately one knot.

According to the Sailing Directions for the Gulf and River St. Lawrence, 6th edition, 1985, section C, the tidal stream at Anse au Foulon has the following characteristics:

> "603 **Anse au Foulon, Québec.** - After a slack period lasting about 35 minutes at Anse au Foulon, during which the flow does not ordinarily exceed 0.3 knot in either direction, the first of the flood stream comes up the north side of the main channel reaching the lower end of the berthing area 1 hour 7 minutes after low water at Québec; the turn at the upper end of the berthing area is about 10 minutes later. The direction of the early flood stream curves outwards from the shore, but 15 or 20 minutes after the turn the direction bends shoreward, and the set is about parallel to the wharves, curving outward again opposite the upper end of the wharves.
>
> 604 The flood stream runs an average time of 4 hours 45 minutes and comes to full strength about 3 hours after low water at Québec. For average tides, the rate of the flood flow along the edge of the channel is about 2.5 knots which holds roughly until 1 hour before high water slack."

The "RICHELIEU" arrived at the dock at approximately 1430, 1 hour and 5 minutes after low water when the current was still weak. It appears that the pilot was very familiar with the tidal streams in this area and that the commencement of the flood tidal stream was not a contributing factor to the casualty.

8. Ice conditions

The following is an excerpt from the ice information bulletin for the St. Lawrence River issued on March 25, 1986 at 1600 EST by the Quebec Ice Office of the

Canadian Coast Guard.

> "General ice conditions
> There is mainly open water from Montreal to Lac St. Pierre with mainly thin brash and first year ice east of this point to Ile aux Coudres. East of Ile aux Coudres there is mainly open water to 66 W. Pieces of batture can break away from fast ice edges and some of these floes can be medium size or larger....."

The start of the ice in the part of Quebec as detailed by the ice observer from the CCGS "DESGROSEILLIERS" at 1425 on March 25 while on aerial ice reconnaisance is as follows.

> "Open water all along the length of the piers on the North shore.
>
> Off, and along the South shore, 4 to 8 tenths of thin first year ice with nilas and brash in small floes."

According to the pilot, ice conditions in the port of Quebec did not create any problems in conducting the "RICHELIEU" to her berth.

9. **Weather conditions**

Weather conditions in Quebec for March 25, 1986 between 1400 and 1500 were the following:

> Sky - slight overcast
> Visibility - 3 miles in snow
> Wind - NE 7 knots

10. **Notice to Shipping**

A notice to shipping, L.508, regarding the lost anchor was issued at 1620 on March 25, 1986. The anchor and chain were recovered by divers at 1532 the next day and notice L.508 was cancelled.

11. **Damage**

The damage to the bow of the "RICHELIEU" was inspected while the vessel was discharging her cargo at Contrecoeur and during repairs at Montreal. The following is a description of the damage.

a) The first striking of the dock, though less violent than the second, parted the vessel's starboard anchor chain and caused slight dents to the bow plating in the area of the anchor recess on the starboard side.

b) At the second striking, the vessel struck the dock violently and pushed back her bow. Damage to the bow and adjacent plating extended vertically from the 4.0 m draught mark up to the forecastle deck, and horizontally to 0.4 m aft of the bow on both sides.

c) Due to a hole in the bow at the 4.0 m draught mark, the forepeak was flooded to the waterline. There was, however, no other ingress of water in any of the forward holds or double bottom tanks and the collision bulkhead remained intact.

Findings

On March 25, 1986, while approaching her berth the Canadian bulk carrier "RICHELIEU" violently struck the dock causing extensive damage to her bow and the dock.

It would appear that the following factors contributed to the casualty:

- the pneumatic main engine remote control system was defective and was the reason for the decision to go to Quebec to carry out repairs;

- the engine manoeuvres had to be carried out at the manual control stand;

- it took longer to carry out the engine manoeuvres since the engine was controlled manually;

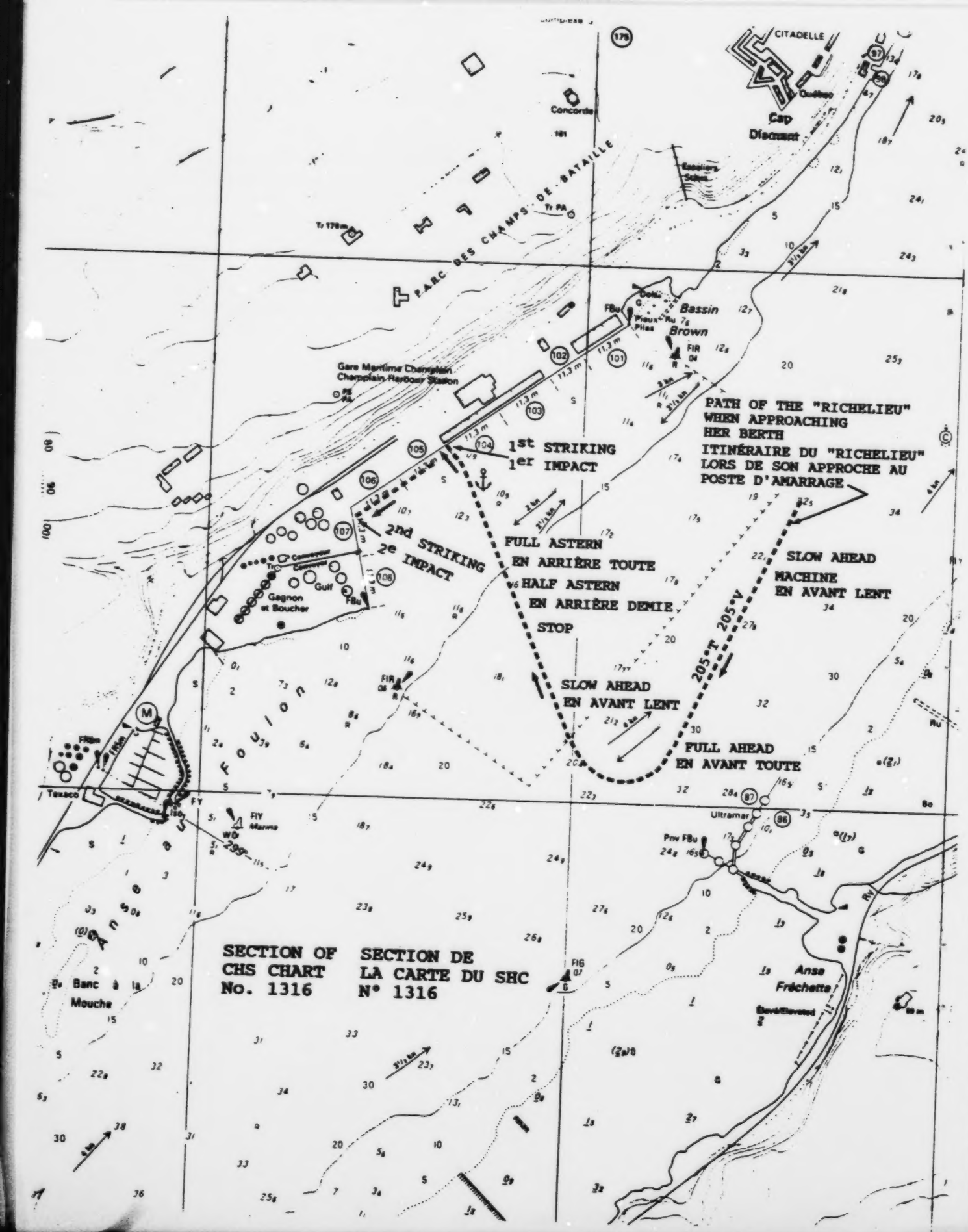
- since the engine-room personnel were not used to manoeuvring the engine from the manual control stand the propeller pitch may not have been adjusted proportionately to the speed of the engine and this would have resulted in a reduction in engine efficiency;

- the error of the E.O.W. in abruptly stopping the engine in the mistaken belief that it was turning the wrong way;

- the stopping of the engine when in the astern mode, and earlier than anticipated by the pilot resulted in the vessel approaching the dock with considerable forward momentum; and

- because of a damaged part in the blocking cam on the shaft of the propeller pitch adjusting knob the engineer at the control stand accidentally reversed the pitch and caused the vessel to move ahead instead of astern as required by the pilot and the master.

OTTAWA, ONTARIO.
NOVEMBER, 1986.


CITADELLE
Québec
Cap Diamant
Concorde
PARC DES CHAMPS DE BATAILLE
Bassin Brown
Gare Maritime Champlain
Champlain Harbour Station
PATH OF THE "RICHELIEU" WHEN APPROACHING HER BERTH
ITINÉRAIRE DU "RICHELIEU" LORS DE SON APPROCHE AU POSTE D'AMARRAGE
1st STRIKING
1er IMPACT
2nd STRIKING
2e IMPACT
FULL ASTERN
EN ARRIÈRE TOUTE
HALF ASTERN
EN ARRIÈRE DEMIE
STOP
SLOW AHEAD
EN AVANT LENT
SLOW AHEAD
MACHINE
EN AVANT LENT
205°T 205°V
FULL AHEAD
EN AVANT TOUTE
Gagnon et Boucher
Gulf
Texaco
Ultramar
Anse Fréchette
Banc à la Mouche
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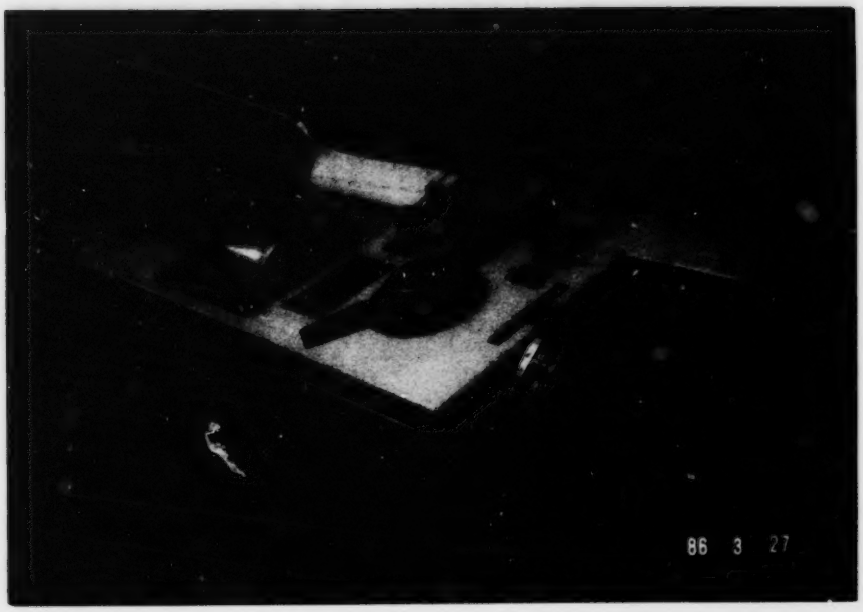
SECTION DE LA CARTE DU SHC N° 1316

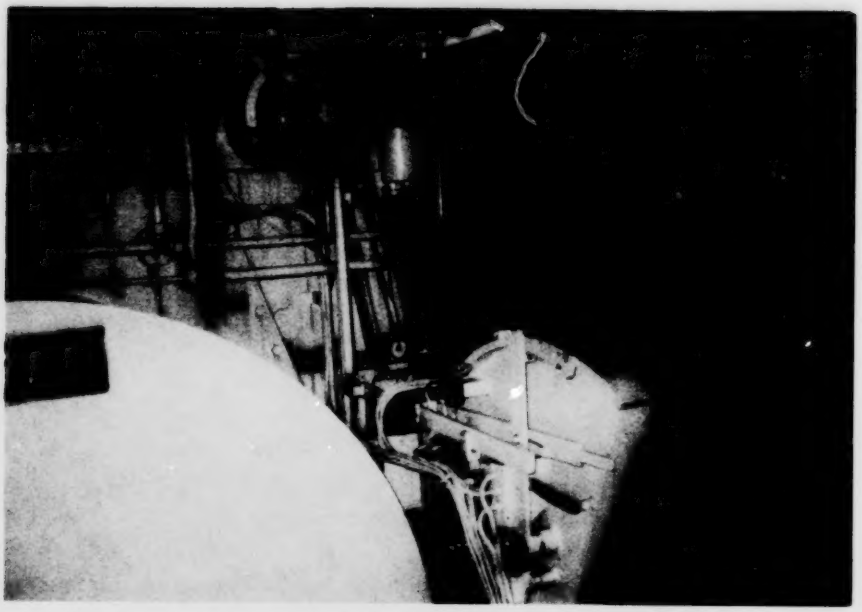


Engine remote control panel in engine-room

Panneau de commande à distance dans
la salle des machines

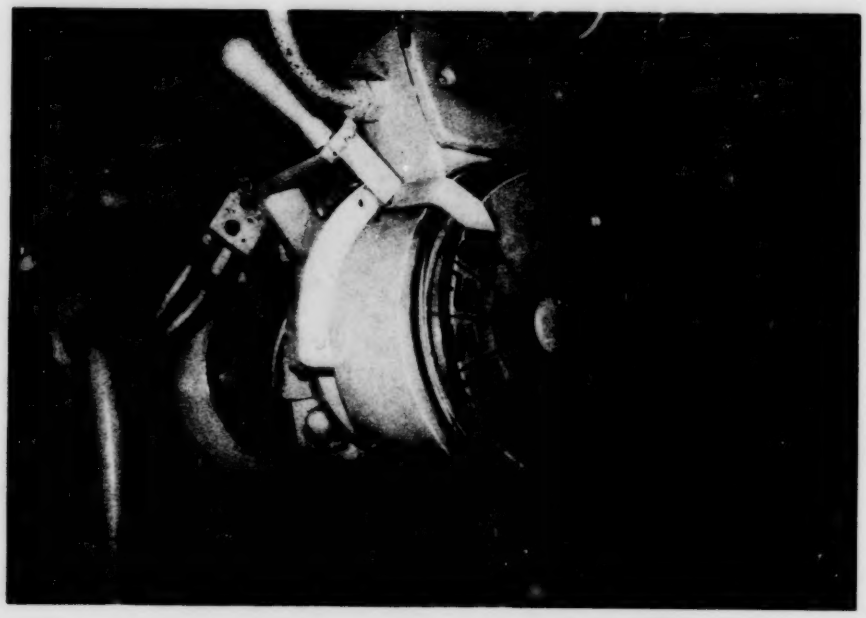
Main engine

Machine principale



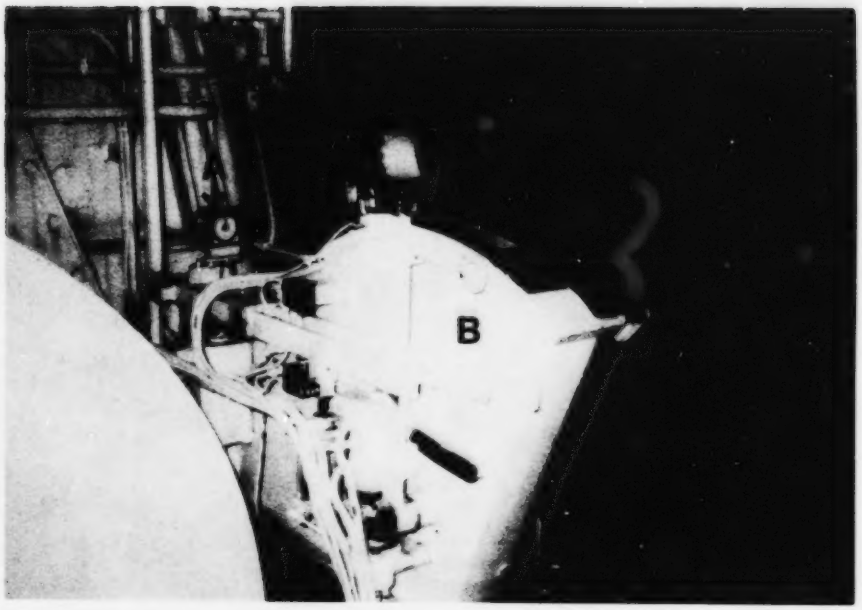
Engine-room telegraph

Transmetteur d'ordres du poste de commande manuelle



A-Air shut-off device which shuts off the air to the other control stations whenever the telegraph handle is moved from "Remote Control" by the engineer.

A-Dispositif ayant comme fonction de fermer l'air comprimé à tous les autres postes de commande dès que le mécanicien déplace la poignée du transmetteur d'ordres.

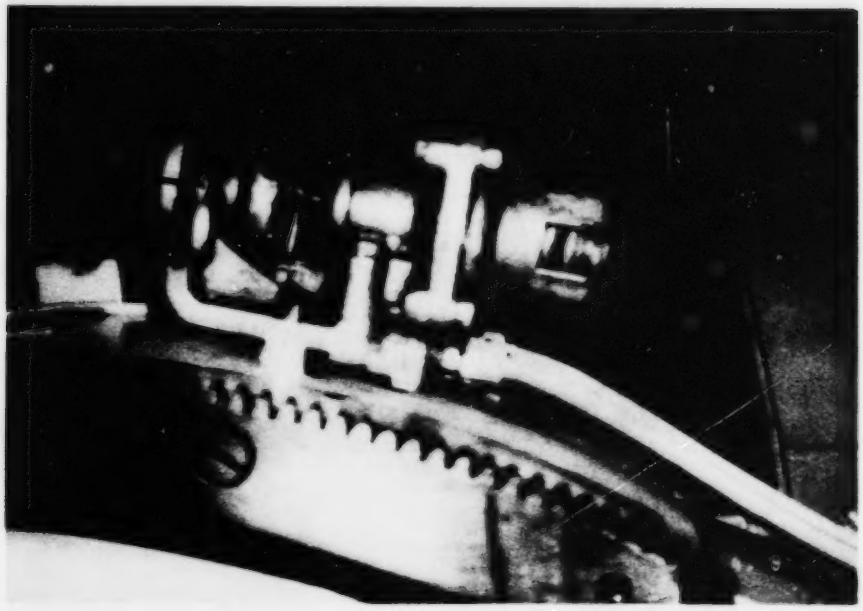


A-Propeller pitch indicator

A-Indicateur de pas de l'hélice

B-Manual control station

B-Poste de commande manuelle

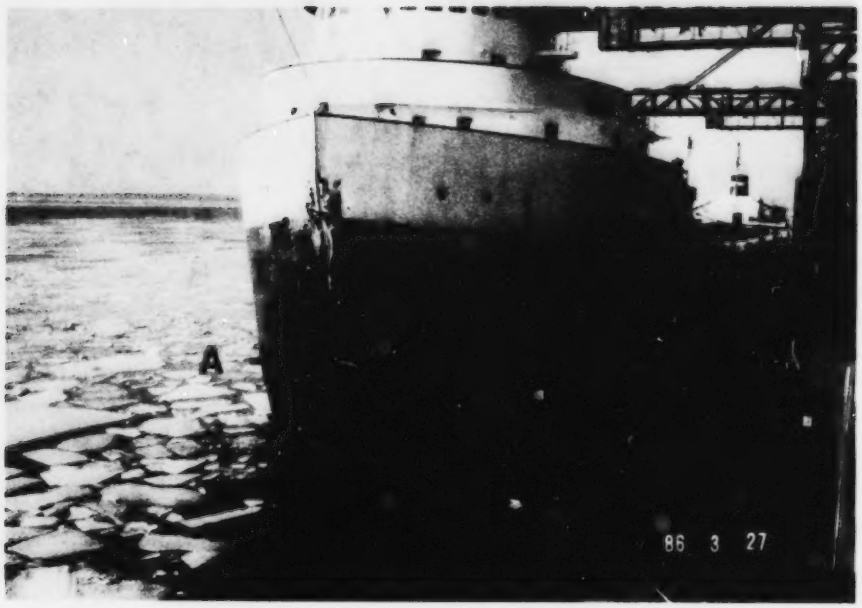


Manual control station

A-Blocking cam

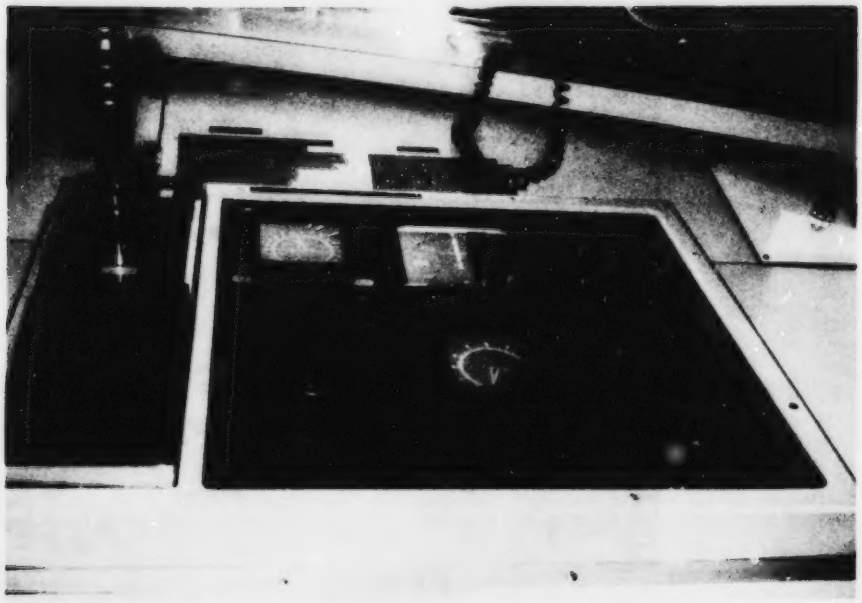
Poste de commande manuelle

A-Came de blocage



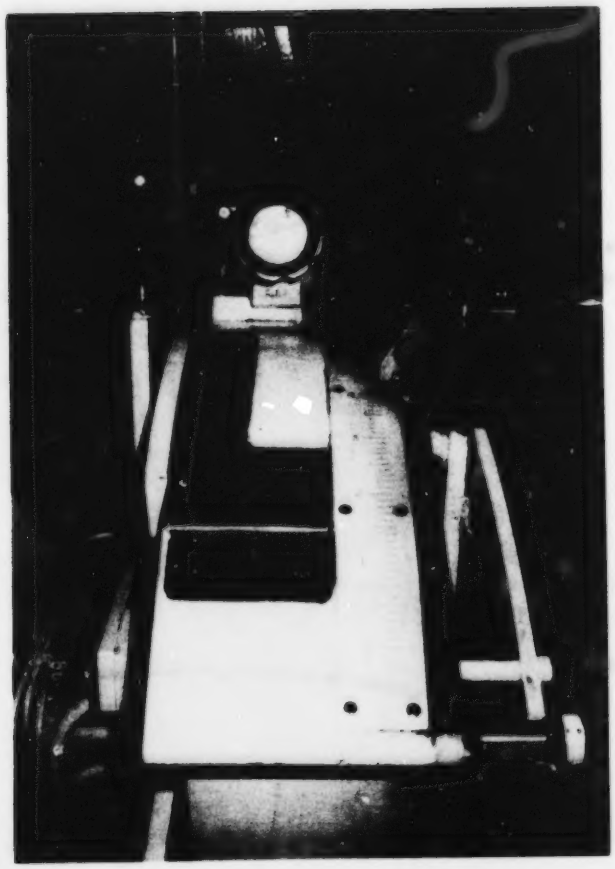
A-Damage to bow while berthing at Quebec
on 25-03-86

A-Étrave endommagée lors de l'accostage au quai
dans le port de Québec le 25-03-86



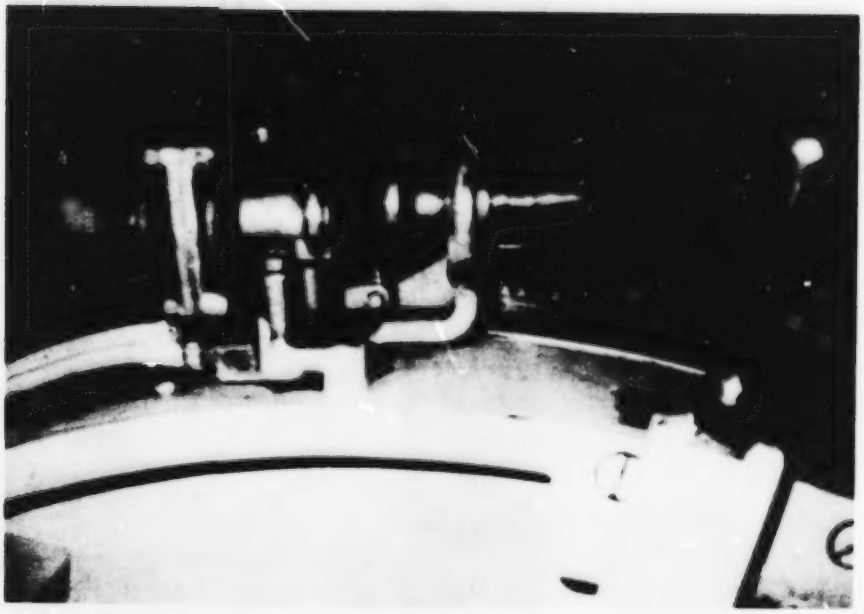
Engine remote control panel on bridge

Panneau de commande à distance sur la passerelle



Propeller pitch adjusting knob on the manual control station

Poignée d'ajustement du pas de l'hélice sur le poste de commande manuelle



Propeller pitch adjusting knob on the manual control station

Poignée d'ajustement du pas de l'hélice sur le poste de commande manuelle

Bow damage repairs in progress in Montreal

Montréal, réparations de l'étrave endommagée